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THE USE OF AMPEROMETRIC DNA-SENSOR FOR TOXICITY ESTIMATION AND DETERMINATION OF NANOCONCENTRATIONS OF HEAVY METALS

Babkina S.S., Ulakhovich N.A.

An amperometric DNA-sensor was developed for a toxicity estimation and determination of nanoconcentrations of heavy metals. Immobilized DNA molecules interaction with heavy metals was studied for the development and optimizing of bio-affinity methods based on DNA-sensor. High affinity of the heavy metals to DNA of the sensor was established and matrix components influence was estimated. This allows use of amperometric DNA-sensor for heavy metals assay in river, drinking water, milk and human blood serum and for estimation of their possible genotoxicity. The results of analysis were compared with the one of reference methods. Heavy metal ions can be determined with the DNA-sensor in real samples at the level of maximum permissible concentration and even lower. The lower limit of detectible concentrations was found to be from 10^{-8} to 10^{-11} M.

DIELECTRIC RESPONSE OF THERMOSETTING POLYIMIDE BASED COMPOSITE MATERIAL CONTAINING NANODISPERCE NI-MO CATALYST

Belov D.A.¹, Stefanovich S.Yu.¹, Yablokova M.Yu.¹, Kuznetsov D.V.², Leybo D.V.²

The influence of nanoparticles of Ni-Mo alloy on curing and relaxation processes in thermosetting polyimide based composite material with glass fibre reinforcement has been studied by the dielectric spectroscopy. It has been shown that nanoparticles of Ni-Mo alloy shows the catalytic activity in process of cross-linking of oligoimides, and that increasing of percentage of nanoparticles results in increasing of cross-link density of forming polymer.

Keywords: nanoparticles, composites, polyimides, dielectric relaxation.

PROSPECTS IN SPATIAL GEOMETRICAL MODELLING OF COLLAGEN FIBRIL

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Article is devoted to spatial modelling of collagen fibril. On the basis of various sources the basic zones of regularity formation in collagen are described. The spatial geometrical model of fibril is offered. The model corresponds to experimental and theoretical data on collagen structure.

Keywords: collagen, fibril, structure, geometrical model, macromolecule

DEPARTMENT OF NANOCRYSTALLINE STRUCTURE AND PROPERTIES OF MULTIPHASE COMPOSITE METAL-CARBON COATINGS ON THE BASIS OF CARBIDES

Blank V.D.¹, Vysykyaylo F.I.¹, Denisov V.N.¹, Kirichenko A.N.¹, Mitin V.S.², Mitin A.V.², Krasnobayev N.N.², Vasylyak L.M.³

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The method for multiphase nanostructured composite coatings (based on carbides of transition metals) with high hardness of 30 GPa, a low coefficient of friction to dry 0,13–0,16, with high heat resistance up to 3000°C and thermal stability in the nanocrystalline state over 1200°C is developed. Management nanocrystalline structure and properties of carbide composite multiphase coatings is performed by varying the concentration of free carbon in them to form in the material of the amorphous phase nanographite. It is established, the presence nanographite in the composite significantly improves the impact strength and extends the range of possible applications, compared with pure carbides.

Keywords: nanocomposite, the properties of nanocomposites, the coefficient of dry friction, temperature resistance of nanocomposites.

SYNTHESIS OF NANOSTRUCTURE SILICA MATRIX FOR IMMOBILIZATION BIOACTIVE SUBSTANCES

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The principles for modification of the matrix of aerosil nanoparticles were developed. The modified matrix was used for immobilization of bioactive substances.

Effectiveness of the chemical assembling and immobilization methods was shown. The nanoparticles have been obtained that can specifically target attached drugs to pathologic cells, thereby avoiding collateral toxicity to healthy cells.

Good biocompatibility of these siliceous nanoparticles was observed. Therefore they can be used in medicine for drug delivery.

Keywords: nanoparticles, silica, nanocarriers, targeted drug delivery, biodegradation.

LOCAL SWITCHING IN SUBMICRON POLYMER FILMS AS THE REASON OF FORMATION OF EMISSION CENTERS.

Yariznov A.M.¹, Kornilov V.M.¹, Lachinov A.N.^{1,2}, Galiyev A.F.²

In this work to study conducting channels that arise in thin polymer films at the local switching under the influence ionic impulses in a vacuum is devoted. The estimation of the minimum charge is sufficient for local switching produced (0,310 Kl). The resistivity of a single switching area is 0,02μ Ohmm. The relation between electron emission from a polymer film and a local switching it was shown.

Keywords: polymer film, electron emission, atomic force microscopy.

SOME ASPECTS OF THE SIZE MEASUREMENTS OF GOLD NANOPARTICLES IN DIFFERENT PHYSICAL STATES

Grigoriev S.N., Loskutov A.I., Oshurko V.B., Uryupina O.Ya., Shamurina M.V.

A comparison of gold nanoparticles (NP) sizes, measured by transmission electron microscopy (TEM), scanning tunneling microscopy (STM) and dynamic light scattering (DLS), is made. The stable gold nanodispersions are produced by chemical reduction gold ions in water medium by using the different derivatives of the cellulose (carboxymethylcellulose (CMC), methylhydroxyethyl cellulose (MHEC) and sodium citrate) not only as a stabilizer, but also as a reducing agent. The largest differences in the sizes of gold NP, identified by all methods, are found in the «Au-CMC» system with bimodal size distribution. In all studied systems the average particle sizes (D) are in the following order: D (DLS-intensity) > D (STM) > D (TEM) > D (DLS-number of particles). In comparison with the TEM and STM data the width of the DLS-distributions is exaggerated. The possible reasons for such contradictions and the relative advantages and disadvantages of the employed measuring techniques are discussed. It is concluded, that although the DLS is the only tool for the nonperturbative and sensitive diagnosis of NP in liquid state now, it is a rather difficult problem to get quantitative results with it. The size of gold NP does not change practically during the processes of the nanodispersion deposition and quasi-crystal formation on solid surfaces. The measured thicknesses of the stabilizing shell (d) are in the following order: d (CMC) > d (MHEC) > d (citrate), which agrees well with the molecular weights of stabilizers.

Keywords: nanometrology, nanoparticles, nanocomposite materials

INVESTIGATION OF MATERIALS BASED ON SILICON DIOXIDE IN THE KINETICS SELF-ASSEMBLY AND SPINODAL DECOMPOSITION OF TWO SPECIES

Moshnikov V.A.¹, Gracheva I.E.¹, Pronin I.A.²

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²*Penza State University, Penza, Russia*

Nucleation growth and spinodal decomposition mechanisms were considered. The features of the cooling sols below the transition temperature were revealed. Models of self-organizing of these structures were proposed. Coagulation models of sol-gel systems describing the experimental results were developed.

Keywords: nanomaterials, silica dioxide, sol-gel nanotechnology, self-assembly, spinodal decomposition

INCREASE IN WEAR RESISTANCE OF A STEEL 35 NANOSTRUCTURING CHANGED SURFACE LAYERS ELECTROSPARK PROCESSING

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Institute of materials FEB RAS, Khabarovsk

Work is devoted increase in wear resistance of a steel 35 nanostructure changed surface layers by electrospark processing by new electrode materials for electrospark alloying with use of nanodispersed powder Al_2O_3 additives in the alloy grade VK8, used for grain growth inhibition. Work is devoted to development of electrode materials for electrospark (ESA) alloying with use of nanodispersed powder Al_2O_3 additives in the alloy grade VK8, used for grain growth inhibition. Introduction in standard alloy VK8 5 wt. % Al_2O_3 promotes reduction of the average grain size about 2,4 microns to 0,84 microns and to increase in microhardness with 12,7 GPa to 17,8 GPa. Process of formation alloyed layer on a steel 35 by means of mechanised ESA by typical alloy VK8 and alloy VK8 with the additive 1–5 mass is studied. % nanodispersed Al_2O_3 . The most effective modes ESA and structure formed alloyed layer are defined: frequency of 400 Hz and duration to 80 microseconds for electrode VK8 about 1% the additive nanodispersed Al_2O_3 . Layer regular strip nano structure consist of nano particles WC formed during ESA in alloying is found by the atomic power microscopy method. Introduction of Al_2O_3 in VK8 results in increase of wear resistance of alloyed layer.

Keywords: Electrode material, nanopowder of Al_2O_3 , inhibitor of grain growth, tungsten carbide, electrospark alloying, nanostructure, combinational (Raman Scattering) light dispersion, atomno-power microscopic researches, wear resistance.

ACOUSTOMETRY OF NANODISPERSE PHASE OF MAGNETIC LIQUID

Polunin V.M., Storozhenko A.M., Ryaplov P.A., Tantsyura A.O., Besedin A.G.

The paper proposed an acoustic technique for measuring magnetic fluid dispersed phase magnetic nanoparticles physical parameters. This method theoretical basis is the acoustomagnetic effect concentration model, the essence of which is revealed by detailing the physical (acoustic, magnetic and thermal) fields interaction. Magnetic fluid sample akustometric results is in satisfactory agreement with the magnetogranulometric analysis data.

Keywords: acoustometric analysis, nanodispersed magnetic fluid, magnetic nanoparticles physical parameters, the disturbance magnetization mechanisms, the concentration model

HYBRID POLYMER-INORGANIC NANOCOMPOSITE ON THE BASIS OF PVDF + ZNS

Magerramov M.A., Mustafayeva A.H., Jabbarova K.Sh.

By method of matrix isolation by means of chemical reactions are received nanocomposite with adjustable concentration nanoparticle zinc sulphide, in a polymeric matrix polyvinildenfluoryde. Structural researches synthesised nanocomposite a method of atom-force microscopy have shown presence clusters sulphide of zinc in the size 25–40 nm. Concentration influence nanoparticle on luminescent properties of samples is investigated. It is established, that intensity of a luminescence of investigated structures increases in process of concentration reduction nanoparticle zinc sulphide.

RADIOABSORPTION PROPERTIES OF CARBON NANOMATERIALS

**Jdanok S.A.¹, Krauklis A.V.¹, Buyakov I.F.¹,
Karpovich V.A.¹, Rodionova V.N.², Tanana O.V.²**

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The results of the reflection coefficient studies of the carbon nanotube (CNT) samples are represented in this work. It is shown that the reflection coefficient of the CNT samples is decreased with increasing of frequency from 0,45 to 0,22. The carbon nanotube samples (CNT powders, CNT suspensions, CNT films) are characterized by the stable high attenuation – from 45 to 60 dB in millimeter wave range.

EXPERIMENTAL INVESTIGATION INTO ELECTROPHYSICAL PROPERTIES OF MICROSCOPIC SAMPLES OF I/AFI NANOCOMPOSITES

**Trifonov S.V., Vanin A.I., Veisman V.L., Gango S.E.,
Kondratyeva M.N., Solovyev V.G.**

Zeolites and zeolite-like materials are well-known regular crystalline porous dielectrics, which can be used as host matrices to design a wide variety of unique nanocomposites by infiltration of their voids and channels with guest substances. In this work, zeolite-like single crystals of AFI aluminophosphate have been prepared by hydrothermal synthesis. Filling one – dimensional parallel nanochannels of AFI host matrix with iodine guest substance by vapor phase adsorption method resulted in the formation of I/AFI nanocomposite.

Electrical properties of small (about 100 microns) nanocomposite I/AFI samples were studied by direct-current measurements, using attached indium contacts. Thermoelectric properties of microscopic I/AFI samples were studied by pulse method using tungsten – gold electrodes.

Current-voltage characteristics, temperature dependences of the electric conductivity, as well as thermoelectric properties of the samples under study have been discussed. Electrical measurements prove the occurrence of the phase transition of iodine species from the chain structures to molecular iodine near $T = 343$ K.

Keywords: Nanostructures, nanocomposites, zeolite-like aluminophosphates, electrical conductivity, thermoelectric power, phase transitions.

ELECTRET PROPERTIES OF THE POLYPROPYLENE MATRIX NANOCOMPOSITES

Yablokov M.Yu., Kechek'yan A.S., Gilman A.B., Ozeri A.N.

ISPM RAS, Moscow, Russia

The results of electret properties measuring are represented for some polymer composites obtained by insertion of nanocarbon fillings into polymer matrix. It is shown that the insertion of diamond batch and diamond of explosion synthesis into polypropylene matrix leads to approximately 4-fold increasing of electret potential of nanocomposites. It is established the correlation between the electret properties of these composites and their contact and adhesive properties.

Keywords: polymer electrets, nanocomposites, nanocarbon materials

NANOTECHNOLOGIES IN THE LEASURE-SHOE INDUSTRY

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In article the current state of the domestic leisure-shoe industry is considered, prospects of the further development of branch are analyzed. Application possibility of advanced nanotechnologies in footwear manufacture is shown.

COMPUTER SIMULATION OF THE FORMATION OF NANOPARTICLES BY SOL-GEL SYNTHESIS

L.U. Ammon

Saint Petersburg Electrotechnical University «LETI» (ETU), Saint-Petersburg, Russia

Development of nanotechnology suggest two approaches to the creation of nanostructured materials: «top-down» and «bottom-up». The first one considers the ultra-dispersed substance and the subsequent formation of the material. Second - the synthesis of nanoparticles through chemical reactions of atoms and molecules as a basis for forming material. In both approaches, the nanoparticle is a central figure in the understanding of the formation of the nanomaterial.

The purpose of this study is to simulate the formation processes of nanoparticles in the sol-gel method by hydrolysis of tetraethoxysilane or silica.

Key words: computer simulations of sol-gel synthesis, nanoparticles

COMPUTER SIMULATION OF THE FORMATION OF NANOPARTICLES BY SOL-GEL SYNTHESIS

Ammon L.U.

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Development of nanotechnology suggest two approaches to the creation of nanostructured materials: «top-down» and «bottom-up». The first one considers the ultra-dispersed substance and the subsequent formation of the material. Second - the synthesis of nanoparticles through chemical reactions of atoms and molecules as a basis for forming material. In both approaches, the nanoparticle is a central figure in the understanding of the formation of the nanomaterial.

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Keywords: computer simulations of sol-gel synthesis, nanoparticles

SOFTWARE FOR COMPLEX ESTIMATION OF NANOMATERIAL FEATURES POTENTIALLY DANGEROUS FOR LIVING ORGANISMS

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The study provides the methodology and algorithm weighted estimations of grouping and ranging nanomaterial features for the evaluation of its potential danger for living organisms. Recently developed software «**NANO toxic**» is proposed to use for systemic automatic analysis and documentation of nanomaterial potential danger calculation on the basis of united approach in accordance with normative-methodical Rospotrebnadzor documents currently in force.

Keyword: nanomaterial, toxicology, calculation, hazard, software.

ПРИБОРЫ ЛАБОРАТОРНОГО И ПРОМЫШЛЕННОГО ПРИМЕНЕНИЯ ДЛЯ ОПРЕДЕЛЕНИЯ ХАРАКТЕРИСТИК ТЯЖЕЛЫХ ЧАСТИЦ В РАСТВОРАХ

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- концентрации наночастиц в водных и органических растворах

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PA FASTSIZER 100 – НАДЕЖНЫЙ ВЫСОКОТОЧНЫЙ ПРИБОР ДЛЯ ИЗМЕРЕНИЯ РАЗМЕРОВ ЧАСТИЦ В ДИСПЕРСИЯХ МЕТОДОМ АКУСТИЧЕСКОГО СПЕКТРАЛЬНОГО АНАЛИЗА



Предлагается прибор PA Fast Sizer 100 производства германской фирмы PA Partikel – Analytik – Messgerate GmbH, предназначенный для определения размеров частиц в концентрированных (10–60 об. %) пробах (образцах) водных и неводных дисперсий с использованием *метода акустического спектрального анализа*.

Прибор может быть полезен при проведении научно-исследовательских работ и для непрерывного контроля промышленных технологических процессов. Для непрерывного контроля технологического процесса в приборе используется датчик проточного типа, в котором отсутствуют движущиеся части.

Изменяемые величины: распределение частиц по размерам и спектр затухания звука.

Сфера применения

Прибор PA Fast Sizer 100 может быть эффективно использован на предприятиях, имеющих такие технологические процессы, как обогащение минералов, фильтрация и дренаж, измельчение и шлифование во влажной среде, контроль гомогенизации, а также в фармацевтике и других отраслях промышленности.

В частности, PA Fast Sizer 100 может быть с успехом использован для оптимизации производства, обеспечения/контроля качества, для решения научных задач и проблем промышленного производства для таких материалов, как керамика, краски и чернила, угольные суспензии, полупроводники, пигменты, люминофоры, пищевые эмульсии, катализаторы и цеолиты, дисперсии наночастиц и наноструктур, средства для шлифовки и полировки, глина, покрытия для бумаги, другие водные и неводные дисперсии.

Достоинства прибора:

- прямые измерения в концентрированных коллоидах;
- малый объем образца, требуемого для исследования;
- быстрота и широкий диапазон измерений.

К преимуществам PA Fast Sizer 100 можно также отнести то, что он не требует:

- задания начального (в грубом приближении) распределения частиц по размерам;
- разбавления исследуемого образца, занимающего время и приводящего к ошибкам.
- калибровочного эталона.

Прибор прост в обслуживании. Он подходит как для научных исследований, так и для промышленного использования в технологических процессах.

Характеристики прибора

Частотный диапазон	1–100 МГц
Затухание звука	От 0,1 до / см
Диапазон размеров частиц	4 нм – 40 мкм
Продолжительность измерения	1 мин
Размеры	37 × 27,5 × 39 см

Характеристики ячейки

Объем ячейки	80 мкл
Объем образца с насосом	50 мл
Концентрация частиц	10–60 об. %
pH	1–14
Вид образца – суспензии и эмульсии	

Комплектация

Прибор PA Fast Sizer 100 имеет модульную комплектацию, которая позволяет расширить его до системы с несколькими датчиками, измеряющими в суспензиях и эмульсиях не только размер частиц, но и дзета-потенциал, вязкость, pH, температуру, проводимость, содержание твердого вещества, скорость звука и проводить анализ микроструктур. Для обработки результатов измерений используется мощное программное обеспечение на основе MS-Excel.

В состав базового прибора Fastsizer входят:

- блок Fastsizer 1 шт.;
- ячейка 1 шт.;
- насос проточного типа 1 шт.;
- насос проточного типа 1 шт.;
- кабель SMA 1 шт.;

- обратный кабель SMA 1 шт.;
- силовой кабель 1 шт.;
- кабель RS 232 1 шт.;
- CD-ROM с программным обеспечением – 1 шт.;
- CD-ROM - мини диск с драйвером интерфейса USB / RS 232 - 1 шт.

В качестве дополнительных опций можно приобрести:

– ячейку 4 мм в дополнение к стандартной ячейке – FS-1005. Применение зависит от значения ослабления (рекомендуется при измерениях разнообразных образцов).

– ячейку 2 мм в дополнение к стандартной ячейке – FS-1010. Применение зависит от значения ослабления (рекомендуется при измерениях разнообразных образцов).

– модуль титрирования объемный – FS-1025.

Насос с двумя шприцами, разрешение 1 мкл.

– термостатированную ячейку – FS-1050.

– ячейку дегазации - FS-1055.

Заказать прибор можно по факсу (495) 332-88-11 или по электронной почте info2@nanotech.ru, nanotech@nanotech.ru, dmitrysokolov@list.ru

Телефоны для справок: 8 903 266 22 22, (495) 332-88-22